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MINIMUM WAGES AND CONSTRUCTION WORKERS EARNING IN INDONESIA

Abstract

This study explores the impact of minimum wages on the wages of construction workers in the informal sector. Using cross-sectional data consisting of 717 samples from 62 construction projects in 24 provinces in Indonesia, we uncover that the variation of construction worker wages across provinces follows the variation of minimum wages. On the demand variables, the magnitude of GDP and workers productivity in a province is not related to construction workers' earnings. While, on the supply side, the level of formality in a province shows a positive relation to construction workers' wages. In addition, the result also supports the previous literature that the nature of construction workers is moving from one project to another across cities as part-time workers. Lastly, another finding is that the base of estimation price in public procurement for the wage of construction workers is market wage.

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1. Introduction

The relation between legislated minimum wages and informal sectors sparks ongoing debates among economists. In the theoretical concept, there are two opposite views. On the one hand, scholars such as Welch (1974) and Mincer (1976) state that higher minimum wage legislation decreases informal wages in an elastic labor demand market due to the mobility of displaced labor from the formal into the informal sector. On the other hand, some experts such as Carruth & Oswald (1981), Leamer (1995), and Harrison & Leamer (1997) provide a general equilibrium model which shows that higher formal wages always increase informal sector wages.

In Indonesia, a profession is always categorized as informal workers (BPS, 2020b); even the workers participate in a government project. The name of this profession is construction workers. Construction workers are the main job of more than 8 million Indonesian people; from that number, only less than 9% possess working-skill certificates (BPS, 2020b). The low level of formal certification resonates with the informality culture of the payment and employment of construction workers. On the employment side, a contractor never has a legal contract with workers (Rahardjo & Bermawi, 2014) and always put them as freelance workers (Stevia Lukmanasari & Soemardi, 2016). On the payment side, a contractor delegates this matter to a *mandor* who functions as a labor provider dan a labor coordinator (Lukiyanto et al., 2015a).

As informal workers, minimum wages legislation does not protect the wages of construction workers. In a construction project, the worker's position determines the wages. The order of position from the lowest wages is helper, handyman, senior handyman, and *mandor*. If a minimum wages regulation protects construction workers, the base wages of a helper will be the same as the minimum wage. In the market, the wages of construction workers are determined by competitive market wages shaped by supply and demand.

Based on the regulation of the Minister of Public Works and Housing number 14/2020, a bidder is subject to fair price evaluation only when offering a price less than 80% of the estimated price. Procurement committees must allow any labor wages despite lower than minimum wages when a bidder offers more than 80% of the estimated price. Suppose a bidder is subject to fair price evaluation. In that case, a committee will accept the bidder's price as long as a bidder can prove that wages, material prices, and rental rates come from market prices, although the wages are lower than minimum wages.

We have collected some data from the construction project procurement of the Ministry of Finance of the Republic of Indonesia (MoF) year 2020. The data shows that the wages of construction workers are diverse across locations and contractors. In Indonesia, the minimum

wages are different at the provincial level. The diversity of construction worker wages may coincide with the minimum wages across provinces and provinces' characteristics.

From the prior paragraphs, we are bringing three primary pieces of information. First, there are two opposite views of economists in the relationship between minimum wages and informal wages. Second, a construction worker in Indonesia always becomes an informal and freelance worker, even in a government construction project. Third, the wages of construction workers are diverse across locations and contractors. From that facts, we want to test the relationship between project location characteristics and worker wages. To find out the relationship, we utilize Statistics Indonesia (BPS) dataset for location characteristics and the Ministry of Finance dataset for workers' wages.

The remainders of this article are structured as follows. Section 2 presents the literature reviews of construction workers and the effect of minimum wages. Section 3 provides an overview of a construction project and its procurement in the Indonesian government. Section 4 explains the data and methodology used, and the final section offers results, analyses, and conclusions of this study.

2. Literatur Review

a. The dual labor market, partial equilibrium approach

The condition of Indonesia's labour market that consists of the formal and informal sector is similar to the concept of a dual-sector economy from Welch (1974) and Mincer (1976). According to Welch (1974) model that is improved by Mincer (1976), the gap ($\dot{w}$) between wage paid by an informal firm (w_1) and the regional minimum wage (w_m), where $\dot{w} = \frac{w_m - w_1}{w_1}$, are having a complex relationship.

Higher minimum wage legislation has opposite effects on the wage gap ($\dot{w}$) and the wage gap ($\dot{w}$) depends on some specific characteristics of the labor market. Mincer (1976) argues that if a formal labor market has a very elastic demand (η) and a low vacancy rate (δ), a higher minimum wage will lead to a lower wage in the informal sector and widening the gap ($\dot{w}$). Vice versa, in a location that its formal labor demand is very inelastic and has a high vacancy rate, a higher minimum wage will also benefit informal workers and narrowing the gap ($\dot{w}$).

In a nutshell, the opposite effect of a higher minimum wage and the wage gap could be illustrated by the diagrams below:

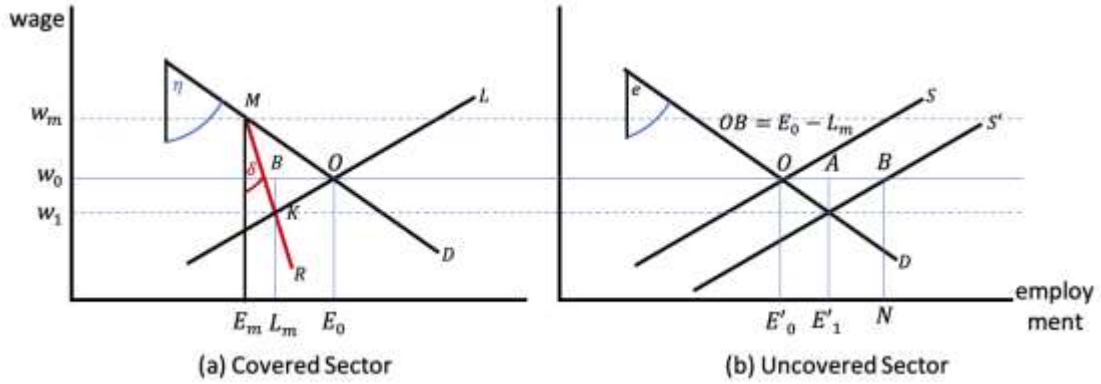

Figure.1: A labour market condition where a higher minimum wage leads to a wider wage gap between formal and informal sectors.

Figure.1 shows an effect of minimum wage legislation in the dual labor market with a high demand elasticity demand and a low vacancy rate ($\eta > \delta$). In this type of labor market, legislation of minimum wage higher than the market wage ($w_m > w_0$) makes formal firms reduce labor from E_0 to L_m. The number of vacancy rates that are less than jobs reduction causes the mobility of formal workers into the uncovered sector. The displaced workers from the formal sector, as many as OB, are looking for jobs in the informal sector. Thus, in the informal sector, the supply curve shifts from s to s'.

The shift of the supply curve in the uncovered sector due to workers mobility from the covered sector creates a new equilibrium of wages and employment. On the wages side, more supply of workers decreases market wages from w_0 to w_1. On the employment side, the lower market wages w_1 makes firms in the informal sector hire more labor from E'_0 to E'_1. The displaced workers that do not accept market wages in the uncovered sector will exit from the labor market.

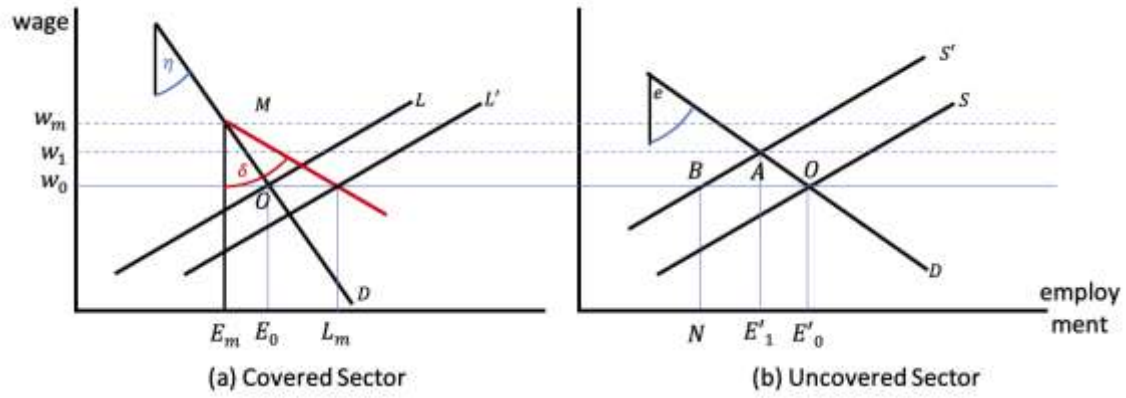

Figure.2: A labour market condition where a higher minimum wage leads to a smaller wage gap between formal and informal sectors.

Figure.2 shows an effect of minimum wage legislation in the dual labor market with a vacancy rate higher than demand elasticity ($\delta > \eta$). Because vacancy rates exceed the elasticity of demand, introducing a minimum wage that is higher than the market wage ($w_m > w_0$) will not cause labor mobility from formal into informal sectors. The higher wage in the formal sector pulls laborers from the informal sector to find jobs in the covered sector. This condition reduces the supply of workers in the uncovered sector. The reduction of workers in the informal sector shifts the supply curve to the left and creates a higher wage market in the uncovered sector from w_0 to w_1.

In the Figure.1 condition, the higher minimum wage worsens the market wage in the uncovered sector. When a minimum wage is getting higher, the gap of wages between the covered and the uncovered sector becomes wider. The higher minimum wage legislated in the Figure.1 market will increase informal economic activities. While in the Figure.2 condition, workers in the uncovered sector are better off due to a higher minimum wage. Higher minimum wage legislation will reduce the wage gap between both sectors and increase formal economic activities.

Aside from labor demand elasticities and the vacancy rate in the covered sector, Mincer (1976) explains that total labor elasticity and the minimum-wage coverage also contribute to the direction of wage and labor mobility. If η and e denote labor demand elasticities in the covered and uncovered sectors, δ is the vacancy rate in the covered sector, and k is the coverage of minimum wage; Mincer (1976) shows that the change of remuneration in the uncovered sector ($\dot{w}_1$) is corresponding to the change of the minimum wage ($\dot{w}_m$) as follows:

$$\dot{w}_1 = \frac{k(\eta - \delta)}{k\delta + (1-k)e}\dot{w}_m$$

A new minimum wage regulation always keeps the sign of $\dot{w}_m$ positive. Therefore, the wage in the uncovered sector is increasing ($\dot{w}_1 > 0$) when $\delta > \eta$, and the wage in the uncovered sector is decreasing ($\dot{w}_1 < 0$) when $\delta < \eta$. Simultaneously, Mincer (1976) also shows that the gap between market wage in the informal firm and the minimum wage ($\dot{w} = \dot{w}_m + \dot{w}_1$) can be translated in an equation as follows:

$$\dot{w} = \dot{w}_m + \dot{w}_1 = \frac{k\eta + (1-k)e}{k\delta + (1-k)e}\dot{w}_m$$

In this equation, the gap between the minimum wage and the market wage of the uncovered sector ($\dot{w}$) is always positive even the informal wages ($\dot{w}_1$) is increasing. This equation also shows that wages in the informal sector are unlikely to raise as much as wages in the formal sector.

b. The dual labor market, general equilibrium approach

Using a general equilibrium approach, Carruth & Oswald (1981), Leamer (1995), and Harrison & Leamer (1997) present a concept of a dual labor market that is different from Welch (1974) and Mincer (1976). They argue that higher formal wages consistently correspond to higher informal sector wages. In this paper, we will mainly present Harrison & Leamer (1997) concept that is able to modify a traditional Lerner-Pearce diagram into a dual labor market condition.

In the standard Lerner-Pearce diagram, any government regulation is assumed to be perfectly applied. Therefore, the standard Lerner-Pearce model only consists of a single labor market, and when a minimum wage is legislated, the coverage is 100%. In the standard model, the economy consists of tradable capital-intensive sectors (i.e., aerospace industries) and non-tradable labor-intensive sectors (mason services). A capital-intensive firm uses relatively more capital than labor to produce an output compared to a labor-intensive service. The disparity of capital intensity between two sectors makes the input price ratio $(\frac{w}{r})$ in the aerospace industries higher than $(\frac{w}{r})$ in the mason services. The higher input price ratio $(\frac{w}{r})$ is also in line with the higher wage level.

The labor market condition under the standard Lerner-Pearce diagram is depicted as follows:

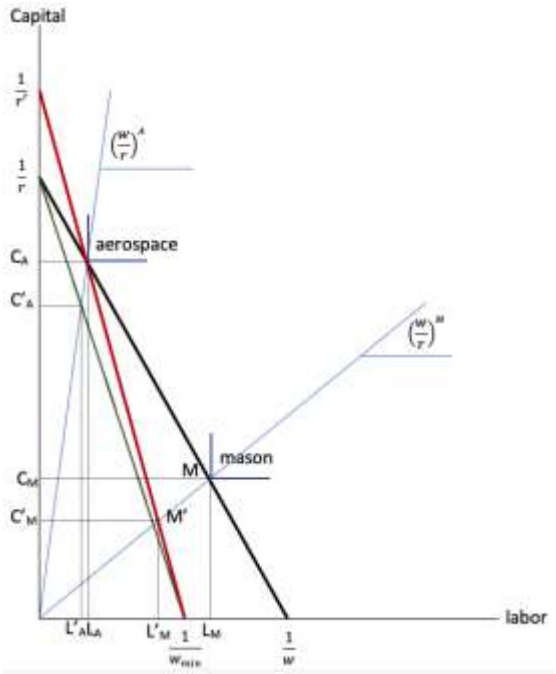

Figure.3: the effect of minimum wage with 100% coverage using standard Lerner-Pearce diagram

Prior to minimum wage legislation, the market wage rate is w, and the rent of capital rate is r. In the labor-intensive sector, the mason services sector, this sector employs labor as much as L_M,

and uses capital as much as C_M. While in the capital-intensive sector, aerospace industries sector, this sector employs labor as much as L_A, and utilizes capital as much as C_A.

When the government legislated a minimum wage as much as w_{min}, the wages in the labor-intensive and capital-intensive sectors are rising. Using the same constraint and the same level of technology, the two sectors' output will drop due to less labour and capital input. However, Harrison & Leamer (1997) explains that empirically, capital owners in the capital-intensive industries will maintain the output by discounting the capital rent rate from r into r'. The new rate of capital (r') will keep three things in the capital-intensive industries: aerospace output, capital input, and labour input. The equilibrium in the aerospace industries post minimum wage legislation is yet at L_A and C_A.

In the labor-intensive sector (mason services), the lower rate of capital (r') is not enough to compensate for higher wages. Therefore, this labor-intensive sector is unable to maintain employment; then, the output must fall. In Figure.3, we can see that the minimum wage legislation makes mason services employ less labor from L_M to L'_M, and reduce output from M to M'.

Harrison & Leamer (1997) explain that the enforcement of minimum wages is never perfectly implemented in all economies, especially in developing countries with a high level of informality. Therefore, the condition of Figure.3 is improbable to occur in the actual ground. Harrison & Leamer (1997) then modify the traditional Lerner-Pearce diagram to accommodate the dual-labor sector consists of covered and uncovered sectors as Figure.4 follows:

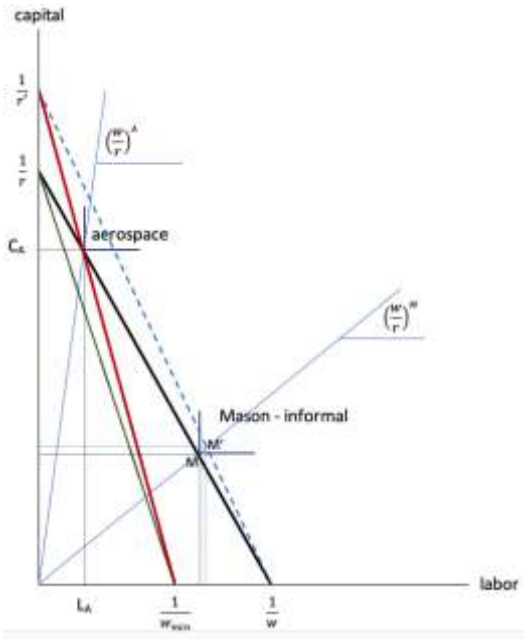

Figure.4: the effect of minimum wage in the dual-labor sector in a general equilibrium model

In an economy that consists of formal and informal sectors, minimum wage legislation does not cover the informal sectors. In this case, we put aerospace industries (capital-intensive) as the covered sector and mason services as the informal sector. When the government legislated a minimum wage, capital owners in the capital-intensive industries will maintain the output by discounting the capital rent rate from r into r'. The new rate of capital (r') will maintain three things in the capital-intensive industries: aerospace output, capital input, and labour input.

As an uncovered sector, Mason services do not apply minimum wages in their payment but get an advantage from a lower rate of capital (r'). The lower price of capital and the absence of minimum wages in mason services make this sector able to increase the output from M to M'. To increase the output, mason services use more capital and labor inputs. Due to the limited number of laborers, the output expansion of mason services will increase the wage market of informal economies.

c. Empirical findings

From the theoretical concepts above, there are similarities and differences. Welch (1974), Mincer (1976), Leamer (1995), Carruth & Oswald (1981) and Harrison & Leamer (1997) agree that minimum wages increase wages in the formal sector. The debate occurs in whether minimum wages harm or benefit the informal sector. Based on that theoretical concept, several empirical studies show similar results on minimum wage effect on formal sector wages. The mixed findings occur in the impact of minimum wages on employment in both sectors and wages in the informal sector.

Maloney & Mendez (2003) empirical study found that a higher minimum wage contributes to the wages hike in formal and informal sectors in Columbia. Maloney & Mendez (2003) also find that the higher minimum wages harm employment in both sectors. In the paper, Maloney & Mendez (2003) explains that Columbia is a country that has high and binding minimum wages. The high degree of minimum wage and enforcement in the Columbian economy is similar to the condition of the traditional Lerner-Pearce diagram. However, in Columbia, the new and lower rate of capital cannot compensate for the new minimum wage. Therefore, a minimum wage makes the level of employment in capital-intensive and labor-intensive sectors shrinking.

Other studies in Latin America by Gindling & Terrell (2007) and Alaniz et al. (2011) find that higher minimum wages decrease formal employment. Although they do not see a significant effect of minimum wages on the informal sector of Latin America, Mincer (1976) theoretical concept seems more suitable to explain the phenomenon. The negative impact on formal

employment after minimum wage legislation in a high informality and low enforcement rate in Costa Rica and Nicaragua aligns with Mincer (1976) theoretical concept.

A study in South Africa by Dinkelman & Ranchhod (2012) find that higher minimum wages increase wages of formal and informal sectors without harming the employment level. According to Dinkelman & Ranchhod (2012), South Africa has a low coverage of minimum wages and a high level of informality. The neutral effect on employment level and positive impact on wages correspond with Harrison & Leamer (1997) concept of the dual sector using the general equilibrium approach.

Delving the effect of minimum wages on the informal sectors, many researchers give attention to Indonesia. This country has a high level of informality and a low level of enforcement. In 2012, Based on 1990 – 2006 Indonesia manufacturing survey data, Del Carpio et al. (2012) find that new minimum wages create labor mobility from formal into the informal sector due to fewer jobs in the formal sector. The evidence of labor mobility from formal into informal sector represents the positive employment effect in the provincial level and negative employment effect in the manufacturing sector level subsequent to a higher minimum wage. Like Del Carpio et al. (2012), Siregar (2019) also finds that higher minimum wages create worker mobility from formal to informal. According to Mincer (1976) theoretical framework, labor mobility will harm informal sector wages. However, Del Carpio et al. (2012) and Siregar (2019) cannot conclude whether worker mobility increases or decreases wages in the informal sector.

Using panel data of Indonesian households' waves 1993, 1997, and 2000 from IFLS, Magruder (2013) finds that a higher minimum wage creates a big push in the decade of Indonesia's economic boom. The higher minimum wages, which coincide with the economic boom between 1990 – 2000, increased wages and employment in the formal sector. The increased demand and vacancy rates in the formal sector pull the workers from the informal sector. Therefore, the workers' mobility from the informal into the formal sector elevates wages in the uncovered sector.

Using different waves of IFLS, Hohberg & Lay (2015) finds similarities and differences with Magruder (2013). Based on IFLS waves 1997, 2000, and 2007, Hohberg & Lay (2015) shows that the higher minimum wages from 1997 – 2007 do not reduce formal employment. In the study, Hohberg & Lay (2015) does not find any significant effect of minimum wages on employment and wages in the informal sector.

The studies of the effect of minimum wages on the informal sector in Indonesia use almost the same period. The period of study from Del Carpio et al. (2012), Siregar (2019), Magruder (2013), and Hohberg & Lay (2015) are around the 1990s to 2000s. Although using a similar period,

their result on the effect of minimum wages on informal wages is unclear. Del Carpio et al. (2012), Siregar (2019), Magruder (2013), and Hohberg & Lay (2015) are unable to conclude whether a new minimum wage harms or benefits informal wages. Only Magruder (2013) concludes that minimum wages during Indonesia economic boom benefits informal earnings.

To get a clearer picture of the effect of minimum wages on the informal sector, we should pick a particular profession that is always categorized as informal. In Indonesia, a profession is always classified as informal workers (BPS, 2020); even the workers participate in a government project. The name of this profession is construction workers. As informal labor, their wages are always determined by market wages. According to our theoretical framework, the wages of construction workers are influenced by the magnitude of minimum wages. To be precise, we should conduct research to quantify the direction and the magnitude of construction worker wages relative to minimum wages.

This paper wants to add to the empirical findings by studying the relationship between minimum wages and construction workers earnings. Usually, studies on the relationship between minimum wages and the informal sector in Indonesia use IFLS and Statistic Indonesia dataset. Both datasets do not provide information on wages in a particular informal profession such as construction workers. In this paper, we use a dataset from Statistic Indonesia and a dataset from construction project procurement of the MoF. Combining the dataset, we can analyze the relationship between minimum wages and Indonesian construction workers earnings.

3. Construction Workers and The Procurement

a. Construction Workers in Indonesia

One of the main tools of the Government of Indonesia to increase the nation's economic growth is through infrastructure development, in this case, the construction sector. The construction sector's role is associated closely with the absorption of labor, the number of infrastructure projects, the investment of capital, the related supporting sectors, and even become facilitators in the movement and growth of goods and services.

Construction is a labor-intensive industry in developing countries, with no exception in Indonesia. The utilization of the large labor force in Indonesia causes the growth of the construction industry to increase from year to year. There is a growing number of workers from 2018 to 2019, from 1,287,225 to 1,344,571 (BPS, 2020a). Growth in the number of construction workers has been accompanied by the growth of the value of completed construction, which is very significant, especially the construction of civil (rise 206.97 percentage). This indicates that

labor in the construction sector has a dominant role in determining the industry's success (Soemardi & Pribadi, 2018).

There are three factors related to construction project management, namely resource management, equipment management, and management system (Lukiyanto et.al, 2015a). In developed countries, project management uses modern management techniques to coordinate human and material resources. Meanwhile, in Indonesia, even for large projects, the contractors combine modern and traditional management techniques. The utilization of workers with low experience and competence is still used in traditional management. In developing countries such as Indonesia, the number of unskilled labor is vast in the construction sector (Lukiyanto et.al, 2015a).

Management and utilization of human resources are the primary focus in industrial construction (Soemardi & Pribadi, 2018). According to Khoramshasi in Soemardi & Pribadi (2018), the management of the construction worker is more challenging than the management of material and other aspects. BPS (2020a) shows that 44.13% of construction workers are just elementary school graduates. This condition potentially affects knowledge transfer, which requires more effort and time from senior employees to junior workers. The low level of education also becomes a challenge in the use of technology in the construction project.

Furthermore, there is a cultural shift in the recent decade where workers do not just follow one foreman or mandor (Lukiyanto et.al, 2015b). Rahardjo & Bermawi (2014) define that "The mandor is a person who has the capability to hire people to work together for a certain time, certain location and for a certain purpose at a construction project." This is due to the fact that first, construction employees working as regular jobs cannot rely on just one foreman/mandor to get a job and fulfil their daily needs. Second, the growing influence of information and telecommunications media allows workers to change their mindset to become a capitalist mindset. According to Olken in Lukiyanto, et al. (2015b), this condition reflects that human resources management becomes more vulnerable because informal workers can move from one project to another easily and freely. In addition, employee loyalty will fade.

From the side of competency, the number of permanent construction employees is less than the number of casual workers or informal workers (BPS, 2020a). Statistics also show that Indonesia's number of skilled workers is still minimal compared to all workers in the construction sector, around 700 thousand compared to 8 million. Skilled workers are workers who have certificates in accordance with the competencies issued by the applicable organization. These

records mean that only around 8.75 percent of workers are registered and are referred to as formal sector workers. At the same time, the rest are considered informal sector workers.

Generally, workers in the construction sector in Indonesia are seasonal workers who work in the agricultural industry. They work on the construction projects after the harvest in their village ends. When the construction project is finished, they will return to their town to continue working as farmers. However, when the agricultural land is getting narrower due to land conversion for other land usages, these workers are working in construction projects as a permanent job, no longer seasonal (Lukiyanto et.al, 2015b). Thus, Soemardi (2011) finds that they work from one project to another or as part-time workers due to limited education and competence.

b. Workers Wage in the Public Construction Project

Based on BPS (2020a), the construction company in Indonesia amounted to around 159 thousand companies and spread throughout the entire territory of Indonesia. The Majority of construction companies are coming from the province on the island of Java (East Java, Middle Java, Yogyakarta, Jakarta and West Java), the province of Riau, and South Sulawesi. This phenomenon is in line with the construction value data completed by the province throughout 2019 (BPS, 2020a). The big three provinces with the highest construction project values are DKI Jakarta, East Java and West Java (BPS, 2020a).

Construction Companies generally use two types of workers, namely formal workers and informal workers. Formal workers are workers who come from within the company, and their working hours are full time. These workers have a career path within the company structure, and they are generally paid monthly. In comparison, informal workers are contracted labor or from outside the company. Casual workers make deals with the company to carry out the particular work during the specific time. Their wages are usually paid on a daily basis.

Not to be denied that workers' wages have a significant portion in the construction budget, approximately around 30% (Stevia Lukmanasari & Soemardi 2016). The wages of construction workers in Indonesia are divided on a daily and monthly basis. The characteristic of the wage for construction workers in developing countries such as Indonesia is that the components of the wages are not arranged in detail. Thus, the contractor is difficult to accurately estimate the burden of the cost of labor for a project (Stevia Lukmanasari & Soemardi, 2016).

In the public procurement of construction projects, the commitment officer (PPK) assigns the components of worker wages in the Bill of Quantity based on minimum wages. Minimum wages in each province in Indonesia are different. Meanwhile, a construction company generally

proposes workers' wages according to the market price when participating in a tender. There is a difference between workers' wages based on minimum wages and wages based on market prices. Usually, wages at market prices are lower than minimum wages. In the first conditions, the company's offer price was lower than the price prepared by the PPK (less than 80%). Another condition is that the company's offer price remains above 80% of the estimated price, but the wage component of workers remains below the minimum wage.

The procurement committee provides different treatments for the two conditions above. For the first condition, the procurement committee must evaluate the fairness of the price. If the company can prove that the wage of construction workers is based on market prices, the committee will accept the proof. Even though the salary is below the market price, for the second condition, the committee will not check the wage as long as the company submits a bid price above 80% of the estimated cost.

4. Data and Methodology

a. Data

The data used in this research is secondary data. Specifically, this study employs data from the Statistics Indonesia (BPS) dataset for 2020 to represent the minimum wages and characteristics of construction project locations. Another data source comes from the Ministry of Finance dataset, which is workers' wages from the construction project procurement year 2020. Accordingly, the sample of this research consists of 717 worker wages from 62 construction projects in 24 provinces in Indonesia. Although the construction projects do not cover all provinces in Indonesia, the sample is considered to have represented all provinces in Indonesia (24 out of 34 provinces).

Minimum wages in Indonesia are different at the provincial level. In 2020, the average minimum wage from 34 provinces is Rp2,664,186.56 per month. DKI Jakarta has the highest minimum wage that is Rp4,276,349.00, while the lowest is Yogyakarta which is Rp1.704.607.00 per month. From 34 provinces, 5 have monthly minimum wages less than Rp2,000,000.00, 19 have monthly minimum wages Rp2,000,000.00 to Rp3,000,000.00, and 10 of them more than Rp3,000,000.00.

Construction wages are also different across contractors and provinces. From 717 samples in 24 provinces, the average helper wage is Rp2,384,799.65 monthly (25 working days). On average, the helper wage in Jakarta is the highest among other provinces at Rp2,790,577.37 monthly. The lowest helper wage occurred in Jawa Tengah that is Rp1,719,833.33 monthly. From our sample, the average helper wages in the four provinces are still less than Rp2,000,000.00

monthly. Those provinces are Jawa Tengah, NTT, Yogyakarta, and Aceh. In the other 20 provinces, on average, the helpers get more than Rp2,000,000.00 monthly.

More detailed information about minimum wages and helper wages are presented in Table1. and Table2. below.

Table1. Indonesia Monthly Minimum Wages 2020		
Mean	Median	Standard Deviation
Rp2,664,186.56	Rp2,595,930.00	Rp552,412.42
		Province
Minimum	Rp1.704.607.00	Yogyakarta
Maximum	Rp4,276,349.00	DKI Jakarta
< Rp2,000,000.00	5 Provinces (14.71%)	Yogyakarta, Jawa Tengah, Jawa Timur, Jawa Barat, NTT
Rp2,000,000.00 – Rp3,000,000.00	19 Provinces (55.88%)	NTB, Bengkulu, Sulawesi Tengah, Kalimantan Barat, Lampung, Banten, Sumatera Barat, Bali, Sumatera Utara, Sulawesi Tenggara, Sulawesi Barat, Gorontalo, Maluku, Jambi, Maluku Utara, Kalimantan Selatan, Riau, Kalimantan Tengah, Kalimantan Timur
> Rp3,000,000.00	10 Provinces (29.41%)	Kalimantan Utara, Kepulauan Riau, Sumatera Selatan, Sulawesi Selatan, Aceh, Papua Barat, Bangka Belitung, Sulawesi Utara, Papua, DKI Jakarta

Table2. Indonesia Helper Wages in A Construction Project 2020		
Mean	Median	Standard Deviation
Rp2,384,799.65	Rp2,250,799.65	Rp580,799.34
		Province
Minimum	Rp1.719,833.33	Jawa Tengah (average)
Maximum	Rp2,790,577.37	DKI Jakarta (average)
< Rp2,000,000.00	4 Provinces (16.67%)	Jawa Tengah, NTT, Yogyakarta, Aceh
Rp2,000,000.00 – Rp2,500,000.00	14 Provinces (58.33%)	Bengkulu, Gorontalo, Sulawesi Tengah, NTB, Sulawesi Selatan, Sumatera Selatan, Sumatera Barat, Bali, Sulawesi Tenggara, Sumatera Utara, Riau, Kalimantan Tengah, Kalimantan Utara, Kalimantan Barat
> Rp2,500,000.00	6 Provinces (25.00%)	Jawa Barat, Kalimantan Selatan, Kalimantan Timur, Sulawesi Utara, Banten, DKI Jakarta

To understand the relationship between wages and minimum wage per province, this journal implements two dependent variables: the gap of wages and helper wages. The definition of the gap of wages is the gap between a helper wage paid by an informal firm in a construction project and the regional minimum wage in each province in Indonesia. Meanwhile, helper wages are the wage of a helper paid by a contractor in a construction project. We use helper wages in this study because helper wages are considered the lowest of all worker wages on a construction project. On the other hand, this study takes the minimum wages in each province in Indonesia as

the independent variable. As previously explained, the minimum wages in each province in Indonesia are different. Minimum wages data comes from BPS in 2020.

Helper wages vary across contractors and provinces. From 717 samples of helper wages from 24 provinces, the average is Rp2,384,799.65 monthly (25 working days). The variation in wages between contractors in a province is lower than the variation across provinces. Across 24 provinces, the average standard deviation is Rp580,799.34. While within a provincial level, the average standard deviation is Rp342,457.35. From 24 provinces, helper wages in 4 provinces are higher than regional minimum wages; those provinces are Jawa Barat, Banten, Yogyakarta, and Kalimantan Barat. Helper wages in 20 other provinces are lower than minimum wages, the highest gap occurring in DKI Jakarta, followed by Aceh and Sulawesi Selatan.

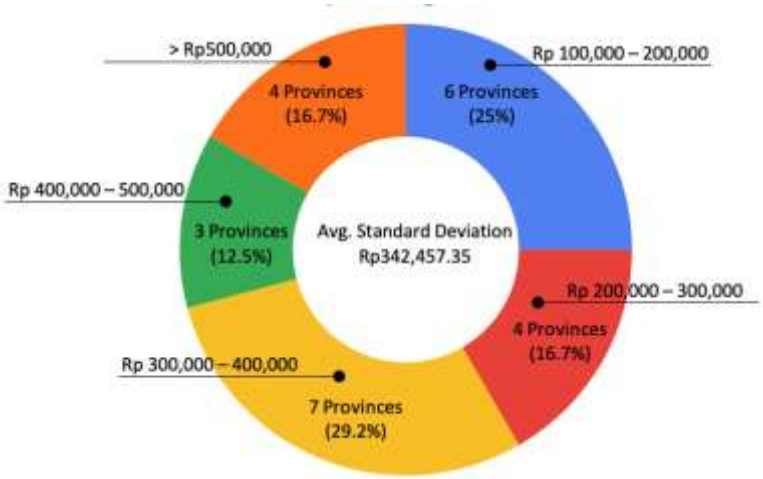

Figure5. The standard deviation of helper wages at the provincial level from 717 samples in 24 provinces

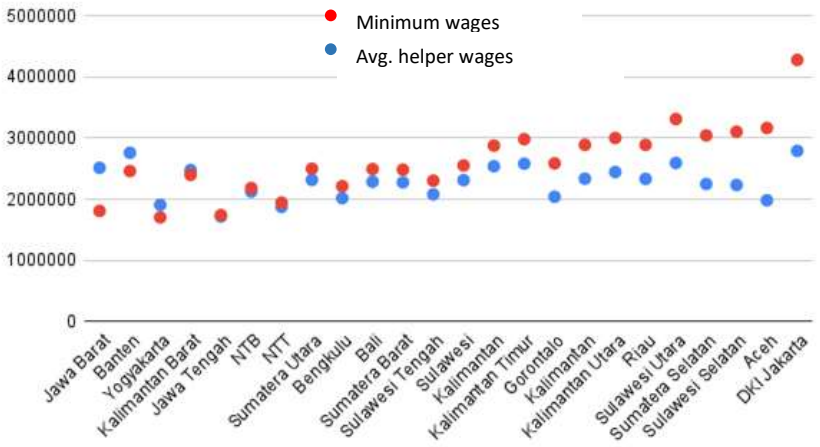

Figure6. Minimum wages and helper wages of construction projects in 24 provinces

In addition, to control for the socioeconomic background of the wages, this study utilizes variables that describe the characteristics of construction work project locations. This study uses data on the Gross Domestic Product of a province, the proportion of formal workers, the number of residents in the working-age and the number of freelance and informal workers in the non-agriculture sector. This study also adds productivity per province by linking the GDP of the province with the number of active workers in the province concerned.

GDP of a province and workers productivity represent labor demand in a particular location (Siregar, 2019). Greater demand may relate to higher market wages for construction workers. However, our data suggest that the variation of helper wages across provinces does not align with workers productivity. The standard deviation of average annual helper wages in 24 provinces is Rp3,330,858.17, while the standard deviation of workers productivity is Rp123,472,928.25. The big gap between helper wages and worker productivity in more affluent provinces may relate to income inequality.

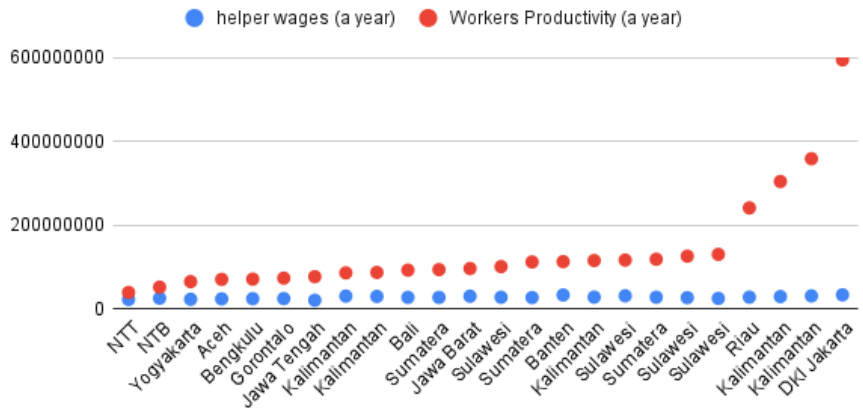

Figure7. Helper wages and workers productivity (a yearly basis)

The proportion of formal workers in a province represents the level of coverage of minimum wage regulation. From partial and general equilibrium approaches, the more coverage and more binding wage enforcement, a minimum wage will give more effect to informal earnings. Our data from 717 samples in 24 provinces indicate a positive relationship between the proportion of formal workers and construction worker wages.

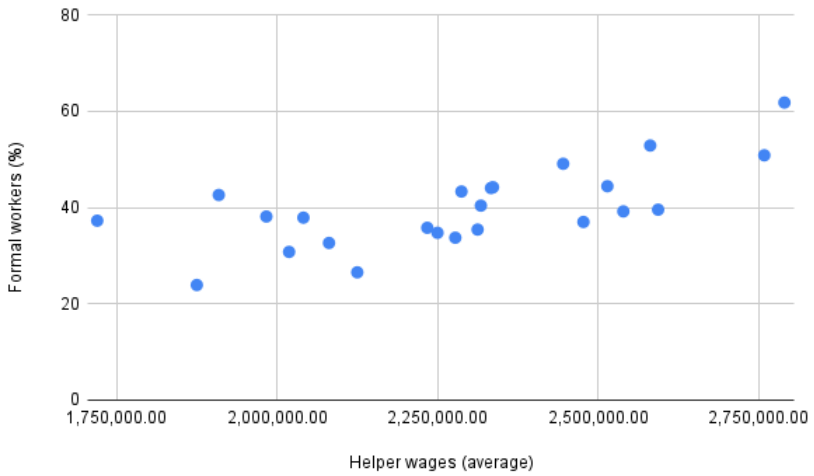

Figure 8. Helper Wages and The Proportion of Formal Workers

The supply of workers is closely related to the number of working-age and non-farming freelance workers. The more supply, the market wage of labor should be lower. However, the higher number of workers in a province may also correlate with higher demand for buildings and more construction projects. We present more complete information about wages, labor supply and labor demand variables of 24 provinces in the table below.

Table3. Helper Wages and The Proportion of Formal Workers								
No.	Province	The average of helper wages (Monthly Rp)	Minimum wages (Monthly Rp)	GDP (Billion Rp)	Workers' productivity (Year Rp)	The proportion of formal workers (%)	The number of working-age	The number of non-farming freelance workers
1	Jawa Tengah	1,719,833.33	1,742,015	1,348,600.40	76,900,576	37.25	27,009,296	1,444,000
2	NTT	1,875,000.00	1,945,902	106,506.13	39,071,126	23.9	3,895,453	71,000
3	Yogyakarta	1,909,223.11	1,704,607	138,388.75	65,083,812	42.59	3,132,754	117,000
4	Aceh	1,983,333.33	3,165,030	166,377.30	70,501,694	38.12	3,881,102	138,000
5	Bengkulu	2,018,750.00	2,213,604	73,336.58	71,070,773	30.77	1,499,572	48,000
6	Gorontalo	2,041,071.43	2,586,900	41,725.90	73,388,349	37.88	893,745	25,000
7	Sulawesi Tengah	2,080,969.58	2,303,710	197,440.78	130,208,178	32.63	2,269,144	61,000
8	NTB	2,125,000.00	2,183,883	133,521.76	51,833,867	26.53	3,817,696	180,000
9	Sulawesi Selatan	2,234,090.67	3,103,800	504,478.54	125,911,252	35.78	6,744,921	118,000
10	Sumatera Selatan	2,250,000.00	3,043,111	458,430.30	112,047,760	34.74	6,307,012	142,000
11	Sumatera Barat	2,277,750.00	2,484,041	242,118.76	93,789,080	33.72	4,016,776	124,000
12	Bali	2,287,343.75	2,493,523	224,214.11	92,519,746	43.31	3,455,127	107,000
13	Sulawesi Tenggara	2,312,500.00	2,552,014	130,184.07	100,978,001	35.41	1,934,802	46,000
14	Sumatera Utara	2,317,576.09	2,499,422	811,282.84	118,569,565	40.38	10,703,311	323,000
15	Riau	2,333,333.33	2,888,563	729,166.64	241,207,256	44.03	4,946,105	112,000
16	Kalimantan Tengah	2,336,458.33	2,890,093	152,190.91	115,459,449	44.2	2,019,517	47,000
17	Kalimantan Utara	2,445,817.31	3,000,803	100,544.34	304,273,199	49.07	522,832	14,000
18	Kalimantan Barat	2,477,375.00	2,399,698	214,001.75	87,052,881	36.99	3,791,656	85,000
19	Jawa Barat	2,514,672.73	1,810,350	2,088,038.74	96,334,616	44.41	37,512,832	1,551,000

20	Kalimantan Selatan	2,539,562.50	2,877,447	179,151.11	85,993,124	39.18	3,154,399	87,000
21	Kalimantan Timur	2,581,428.03	2,981,378	607,320.78	358,767,849	52.86	2,775,171	52,000
22	Sulawesi Utara	2,593,750.00	3,310,722	132,299.41	116,583,695	39.54	1,931,636	73,000
23	Banten	2,759,197.17	2,460,968	626,437.44	112,827,456	50.83	9,636,060	340,000
24	DKI Jakarta	2,790,577.37	4,276,349	2,772,381.12	595,027,209	61.78	8,199,694	150,000

b. Methodology

Answering research questions, this study will employ statistical methods, Ordinary Least Squares in the context of multiple regression models by using cross-section data. Multiple regression analysis helps to observe many variables that affect the dependent variable (Wooldridge, 2016 p.63). In addition, the data that we will use are taken at a specific time, which is 2020. In order to obtain unbiased results, this research needs to fulfil several assumptions, namely, linear in parameters, random sampling, no perfect collinearity, zero conditional mean, homoscedasticity and normality (Woldridge, 2016). This study obtained a random sampling of wage data for workers in the Ministry of Finance procurement with a reasonably vast sampling number. Analysis of cross-sectional data is also commonly used for applied microeconomics such as labor economics.

A structured model is proposed to examine the relationship between minimum wages, the gap of the wages, and wages that a contractor pays in a construction project based on a conceptual framework. The model consists of 8 variables with a total of 717 samples. In order to obtain unbiased results, we should detect violations of classical assumptions, namely multicollinearity, heteroscedasticity and autocorrelation, using the STATA program.

Multicollinearity is a linear relationship between independent variables (Nachrowi and Usman, 2002). We need to do a Multicollinearity test to check whether a model has a "perfect" or "almost perfect" linear relationship between several independent variables. Although in practice, generally multicollinearity cannot be avoided (Nachrowi and Usman, 2002. This is because it is difficult to find two independent variables that are mathematically uncorrelated (correlation = 0). However, we need to pay attention if there is significant multicollinearity.

In econometrics, a situation where the variance ($\sigma 2$) of the confounding factor it or error terms, or disturbance error is arbitrary for all observations or observations on the independent variable is called homoscedasticity (homoscedasticity) or the same variance. If the value of the variance of the dependent variable increases as a result of increasing the variance of the independent variable, the variance of the dependent variable is not the same. In econometrics, this is called the heteroscedasticity condition. The essence of heteroscedasticity is the variance of the error term not constant, or there is an error term correlation with the independent variable. Nachrowi & Usman (2002) explain why we should pay attention to heteroscedasticity because if the variance of the regression coefficient is wider, it will impact the inaccuracy of the hypothesis and will subsequently impact the inaccuracy of the hypothesis affect the accuracy of the conclusion.

For autocorrelation assumptions, violations of these assumptions are more often found in time series data (Nachrowi & Usman, 2002). This is because time series data is the history of certain characteristics of an individual. In comparison, this study will only use a particular time, namely 2020, for various individuals.

5. Results, Analyses, and Conclusion

a. Empirical Model

Based on theoretical frameworks, data, and methodology above, we use this econometric model:

$$y = \beta_0 + \beta_1 w_{mj} + \beta_2 GDP_j + \beta_3 Prod_j + \beta_4 Formal_j + \beta_5 Wa_j + \beta_6 Fw_j + \varepsilon$$

Where:

Table4. Variables in the empirical model

Variables	Definition	Notation
Dependent variables		
Gap of wages	The gap ($\dot{w}$) between a helper wage paid by an informal firm (w_1) in a construction project and the regional minimum wage in province j (w_{mj}), where $\dot{w} = 100 + \frac{w_m - w_1}{w_1} x100$ We add 100 to avoid negative results when a helper wage is higher than the regional minimum wage. The lower the helper wage, the higher the gap ($\dot{w}$). When $\dot{w} = 100$, a helper wage is equal to the regional minimum wage. When $\dot{w} > 100$, a helper wage is less than the regional minimum wage. When $\dot{w} < 100$, a helper wage is more than the regional minimum wage.	$\dot{w}$
Helper wages	The monthly wage of a helper paid by a contractor in a construction project, in a hundred thousand Rupiah (Rp100,000).	w_1
Independent variable		
Minimum wages	A minimum wage in a province j, in a hundred thousand Rupiah (Rp100,000).	w_{mj}
Control variables		
GDP	A gross domestic product in a province j, in a billion Rupiah (Rp1,000,000,000,000)	GDP_j
Workers productivity	GDP of province j divided by the number of workers in province j, in a million Rupiah (Rp1,000,000)	$Prod_j$
The proportion of formal workers	Share of formal workers in a province j, in 1-100 scale	$Formal_j$
Number of working age	Number of the population more than 15 years old in a province j, in a hundred thousand (100,000)	Wa_j
Number of non-farming freelance workers	Number of freelance and informal workers in the non-agriculture sector in a province j, in a hundred thousand (100,000)	Fw_j
Error term	-	E

b. Results

The author needs to tackle issues related to the violation of classical assumptions, namely multicollinearity and heteroscedasticity. First, for the issue of multicollinearity, we have tested the correlation of the independent variables and the Variance Inflation Factor (VIF) test. We found that there was a reasonably high correlation between the GDP and worker productivity variables. However, we estimate that these two variables are essential to remaining in the model. In addition, the model in this study is also in line with Siregar's research (2019), where the researcher places GDP and Productivity of workers as independent variables in one model. This is done to avoid "specification bias", which is a condition where the author excludes the independent variable, which is very important in a model (Nachrowi & Usman, 2002). In addition, multicollinearity also does not violate the Gauss Markov assumption. It does not violate the OLS assumption, so the study can still obtain the BLUE (Best Linear Unbiased Estimator) results.

Second, we have done some work to overcome the assumption of heteroscedasticity. We used the graph method, White Test, Breusch-Pagan Test and Glejser Test to detect heteroscedasticity in the model. The author needs to try several alternative solutions to handle the issue: the natural logarithm transformation (Ln) or the weighted least squares method. We apply the second option using the STATA program. Finally, the model has been consistent

The regression outcomes of the relation between construction worker wages and minimum wages are presented in the table below:

Table5. Regression results

	Gap of wages		Helper wages (100.000)	
Variables	Coefficients	Robust SE	Coefficients	Robust SE
Intercept	58.2492**	8.4675	7.3609**	1.6188
w_{mj}	4.1426**	0.3331	0.1570**	0.0496
GDP_j	0.0000*	0.0000	0.0000**	0.0000
$Prod_j$	-0.0364	0.0218	0.0038	0.0043
$Formal_j$	-0.9774**	0.1438	0.2423**	0.0363
Wa_j	-0.2739**	0.0767	0.0772**	0.0133
Fw_j	4.9117**	1.5318	-1.2477**	0.2438
	Multiple R 0.7346 R Square 0.5397 Standard Error 25.6576 Observations 717		Multiple R 0.5253 R Square 0.2760 Standard Error 4.9628 Observations 717	
p-value < 0.01 = **, p-value < 0.05 = *				

The outcome shows a significant relation between minimum wages (w_{mj}), gap of wages, and helper wages. From that result, we can say that the higher minimum wage in a province increases the gap of wages. However, the higher wage gap does not harm the construction worker

wages. In the regions that have relatively higher minimum wages, the construction worker wages are also higher.

From the coefficients' magnitude, the regression shows two main pieces of information related to minimum wages. First, a hundred thousand higher minimum wages correlate to 4.14 points of a higher wage gap. Second, a hundred thousand higher minimum wages relate to Rp15,700 higher helper wages.

The direction of the relationship between control and dependent variables is parallel to the law of supply and demand. Provinces' GDP (GDP_j) and workers productivity ($Prod_j$) are among labor demand factors. Whereas the number of working-age (Wa_j) and the number of non-farming freelance workers (Fw_j) affect the labor supply.

The proportion of formal workers ($Formal_j$) in the regression model represents the coverage of minimum wages regulation. The regression outcome shows that the higher formality is associated with the lower wage gap and the higher construction worker wages.

c. Analyses

Minimum wages and construction worker wages

Using 717 observations from the real ground and competitive procurement processes, we manage to extrapolate the relationship between minimum wages and informal wages. In the empirical model, we include location characteristics at the provincial level as control variables. The control variables may bring the relationship between minimum wages and informal wages becomes statistically significant. Moreover, location characteristics also manage to interpret the variation of construction worker wages across regions with similar minimum wages levels.

A helper in a construction project has the lowest position and the lowest-earning compared to other workers. Therefore, a helper wage is a suitable parameter for comparing construction workers' market wages and minimum wages. The regression result shows that the magnitude of minimum wages is in line with the market wages of construction workers and the gap of wages.

In the dual sector labor market theorem with a partial equilibrium approach, workers mobility is the leading cause of a hike or fall of informal wages. When a new minimum wage is followed by workers' mobility from a formal into an informal sector, the wages of the informal sector fall and its output expands. Vice versa, the wages of the informal sector hike, and the output is shrinking. While in the general equilibrium approach, the change of informal wages is due to the growth or the contraction of output. If a new minimum wage is followed by the growth of

informality, the wages in the uncovered sector will increase. Vice versa, if a new wage regulation is followed by a reduction of informal activities, the informal wage falls.

Our regression result shows positive and significant relation between minimum wages (w_{mj}), the gap of wages, and helper wages. This finding portrays some critical points concerning formal and informal wages subsequent to a higher minimum wage. First, a higher minimum wage benefits both formal and informal earnings. Second, the formal sector gets more benefit from higher minimum wages as a higher gap of wages happens in the provinces with higher minimum wages. Third, the higher minimum wages correlate to the busier construction activities. According to the general equilibrium approach, an output expansion is the main cause of higher wages in the informal sector. A positive and significant relation between minimum wages (w_{mj}), the gap of wages, and helper wages indicate busier construction activities in the provinces with higher minimum wages.

Our empirical finding also shows that a general equilibrium approach is more suitable to explain Indonesia dual labor market. The relation between formal and informal wages is easily understood using Harrison & Leamer (1997) diagram that shows a similar direction between formal and informal wages. As a developing country with a low enforcement level on labor regulation, a lower rate of capital that follows higher minimum wages will prosper Indonesia's informal economy and informal workers.

In the partial equilibrium approach theorem, Welch (1974) and Mincer (1976) argue that formal and informal wages walk in the opposite direction, except there are conditions causing workers mobility into the formal sector. Those conditions are a high vacancy rate and an inelastic demand in the formal sector. Workers' mobility into the formal sector makes labor scarcity in the informal sector. This scarcity then moves informal wages to a higher level. However, this concept is not suitable to explain our findings because it is hard to compute vacancy rate and demand elasticity from annual economic surveys and there is no indication of labor mobility into the formal sector.

Location characteristics and construction worker wages

The variables of location characteristics represent labor supply and demand factors. We put the GDP of a province (GDP_j) and workers productivity in a province ($Prod_j$) as variables that affect labor demand. In the labor supply, we put the number of working-age in a province (Wa_j) and the number of non-farming freelance workers in a province (Fw_j). We also put the proportion

of formal workers in a province ($Formal_j$) to monitor the coverage of minimum wages regulation in each province.

Relating to the theoretical frameworks, the magnitude of labor supply and demand can shift the equilibrium of wages in the formal and informal sectors. For informal workers, greater wages should occur in the regions that have greater labor demand. However, regression results show insignificant relation between workers productivity in a province $(Prod_j)$ to the gap of wages and helper wages. GDP of a province (GDP_j) also shows zero effect on wages and helper wages.

The insignificant relation between workers productivity in a province and helper wages may occur because of unequal magnitude patterns. The mean and median of helper wages are just around 2 million Rupiahs. On the other hand, the mean and median of workers productivity show a high discrepancy, the former is Rp138,975,021.38, and the latter is Rp98,656,308.50. The unequal pattern between productivity and helper wages is also shown in the Figure7. Helper wages and workers productivity (a yearly basis).

On the workers supply side, the number of working-age in a province (Wa_j) and the number of non-farming freelance workers in a province (Fw_j) show a significant relationship to the gap of wages and helper wages. In the provinces with more non-farming freelance workers (Fw_j), the construction workers get less wage and more gap to the minimum wage. On the other hand, in the provinces with a greater number of working ages (Wa_j), the construction workers get more earnings and less gap to the minimum wage. That phenomenon indicates that a greater number of working ages may coincide with busier construction projects resulting in more demand and more earnings for construction workers.

Level of formality and construction worker wages

The level of formality as a proxy of minimum wage coverage shows a significant relationship to the gap of wages and helper wages. The regression result shows that higher formality means more earning and less gap to minimum wages. This finding confirms the logic of partial and general equilibrium approaches, which implies that higher coverage and enforcement of minimum wages will give more effect to the informal sector.

d. Conclusion

Based on the data and analysis above, we can conclude some points. First, the variation of construction worker wages across provinces follows the variation of minimum wages. However,

the base earning of construction workers is not minimum wage, but a market wage. Second, the magnitude of GDP and worker productivity in a province is unrelated to construction workers' earnings. This finding may indicate that construction workers productivity across regions is more or less equal. If the productivity of construction workers in provinces with high productivity are in line, the market wages should follow the pattern of workers productivity. Yet, figure 7 shows that helper wages and workers productivity across provinces walk in different ways. Third, the level of formality in a province shows a positive relation to construction workers' wages. This phenomenon implies that a higher minimum wage does not harm informal sector earnings. Fourth, the minor variation of workers wages across provinces confirms Soemardi (2011) finding that the nature of construction workers are moving from one project to another across cities as part-time workers.

Regarding public procurement, the commitment officer (PPK) in each government office should realize that, in general, base wages for construction workers are less than minimum wages. Therefore, the commitment officers (PPK) are better to use market wages as the base of estimation price rather than minimum wages. Utilizing market wages as a base of project value will increase the quality of price estimation and encourage tighter competition among contractors.

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